

Influence of information about trip time variability, personal benefits, and environmental harm from cars versus public transportation on the choice of transportation mode

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Título: Influencia en la elección de modo de transporte de la información sobre variabilidad en el tiempo del viaje, beneficios personales y daño ambiental del coche versus transporte público.

Resumen: En un estudio experimental, se examina la influencia en la elección de modo de transporte, para desplazarse al lugar de trabajo, de la información sobre la variabilidad del tiempo del trayecto, los beneficios personales o los daños ambientales de utilizar coche o transporte público. Además de estas variables, manipuladas experimentalmente, se ha comprobado la influencia de las actitudes previas hacia el metro. La muestra está compuesta por usuarios habituales de coche para ir al trabajo ($N = 220$, edad $M = 37.4$, $SD = 8.1$, 63.2% mujeres). Los resultados muestran que proporcionar información sobre las ventajas del transporte público, así como las actitudes previas hacia el metro, disminuyen la preferencia, la elección y la percepción de control del uso del coche. De las variables manipuladas experimentalmente, la información sobre la variabilidad del tiempo del trayecto es la que más influye. Estos resultados ponen de manifiesto la importancia de tener en cuenta estas variables al implantar campañas institucionales para disminuir el uso del coche como modo de transporte para ir al trabajo.

Palabras clave: actitudes; modo de transporte; influencia social; movilidad al trabajo; medio ambiente.

Abstract: The influence of information about trip time variability, personal benefits, or environmental harm from cars or public transportation on commuting mode choice (car or subway) is examined in an experimental study. In addition to these experimentally manipulated variables, the influence of prior attitudes towards the subway was verified. The sample is made up of habitual users of the car to travel to work ($N = 220$, age $M = 37.4$, $SD = 8.1$, 63.2% women). The results show that providing information about the advantages of public transportation, as well as prior attitudes towards the subway, decrease the preference, choice, and perceived control of car use. Of the experimentally manipulated variables, information about the variability of trip time had the greatest influence. These results highlight the importance of taking into account these variables to implement institutional campaigns to reduce car use as transportation mode.

Key words: attitudes; mode choice; social influence; commuting; environment.

Introduction

Excessive use of the private car versus public transportation has become a severe problem in cities. Issues arising from this use such as urban congestion, accidents, air and acoustic pollution, and high energy consumption lead to negative consequences for citizens' economy and well-being. In the European Union (European Commission, 2009), transportation is responsible for a large part of the total emissions of greenhouse gas and CO₂ (24 and 28%, respectively); and in Spain, where this study was conducted, the private car represents about half of the energy consumed by Spanish families (Instituto para la Diversificación & Ahorro de la Energía [Institute for the Diversification and Saving of Energy] - IDAE, 2007), more than half of the trips to work are by car, and car use has increased in relation to public transportation despite that new public transportation infrastructures have been created (Monzón, Cascajo, & Alonso, 2013).

In addition to the pollution and acoustic contamination, there is another specific consequence derived from the overuse of cars in cities, which also has an impact on health: the deterioration of inhabitants' physical fitness. People who use public transportation walk an average of 8.3 minutes more than people who travel by car (Edwards, 2008), leading to a

reduction in rates of obesity and in the prevalence of cardiovascular and respiratory diseases.

The study of urban mobility has mainly focused on the utilitarian aspects that each transportation mode provides to the user, such as trip duration or cost. An example of this approach is the theory of discrete choice (Ben-Akiva & Lerman, 1985), which explains the usage frequency of a transportation mode as a function of variables such as place of residence and/or work, or the possession of a private car. Nevertheless, from other perspectives, the choice of a certain transportation mode is considered much more complex and, although choosing a mode is conditioned by the infrastructures involved in the activity to be carried out, many aspects related to mobility behavior do not depend only on this kind of structural factors (Domarchi, Tudela, & González, 2008; Mokhtarian & Salomon, 2001). The consideration of psychosocial variables that affect mobility behavior has gained weight in the explanatory models, as we need to understand which behaviors contribute to the traffic problem in cities, which factors influence such behavior, and how these behaviors can be modified to mitigate the problem (Steg & Gärling, 2007).

The psychosocial approach to the problems caused by traffic has mainly focused on analyzing the factors that influence car preference in order to understand how these problems could be reduced by changing users' behavior, focusing on the role of attitudes as a mediator between users and their physical and social context.

The formation and expression of attitudes may be related to diverse psychological needs. This functional nature is a

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crucial aspect for understanding how an attitudinal object is appraised. In this line, some authors have underscored the influence of values (Moreno, Corraliza, & Ruiz, 2007; Van Lange, Van Vugt, Meertens, & Ruiters, 1998; Van Vugt, Meertens, & Van Lange, 1995; Van Vugt, Van Lange, & Meertens, 1996), as well as of symbolic processes (such as status and social comparison), or affective and emotional processes (Gatersleben, 2007, Lois & López-Sáez, 2009; Steg, 2005; Steg & Tertoolen, 1999; Steg, Vlek, & Slotegraaf, 2001).

Attitudes towards transportation modes largely arise from beliefs, such as the practical advantages and disadvantages associated with the use of public transport, the car, the bicycle or traveling on foot. There may also be symbolic beliefs related to power and status that are linked to a certain type of vehicle or to meanings involving important identity aspects, such as using a transportation mode that does not pollute and that respects the environment, or that benefits health (Ennis & Zanna, 2000; Gatersleben & Haddad, 2010). Another essential aspect in attitude formation are the affects (whether these be emotion, mood, or feelings) linked to the attitudinal object. In this line, Stokols, Novaco, Stokols, and Campbell (1978) confirmed that traffic congestion leads to increased stress for drivers. With respect to the stress associated with traveling in public transportation, Evans, Wener, and Phillips (2002) showed that the lack of control over the circumstances of the trip is the most influential variable. Gatersleben and Uzzell (2007) verified that the daily trip to the workplace can provoke feelings of stress and boredom, but it can also be relaxing or exciting.

Positive attitudes towards the car are based on its short-term effects for each individual's quality of life, whereas the benefits of public transportation on health or the environment are long-term and social, rather than individual. On the basis of a review of the works that have addressed this kind of components, Jakobsson (2007) concluded that the car is valued more positively than other means of transportation because of the practical aspects related to its immediate advantages, such as availability, reliability, and speed. This perception of drivers is positively related to higher car use and negatively to their disposition to reduce trips by private car. However, the car obtains a lower score in attributes such as cost—both in maintenance and fuel—and the deterioration of the environment, that is, long-term advantages.

Institutional policies to promote the use of public transportation usually emphasize the social benefits of limiting car use in cities through information about the impact of private vehicles on the environment. However, if we want to change citizens' attitudes and motivations with this type of campaigns, the short-term advantages of public transportation for individuals, as well as the disadvantages of the car, should be emphasized. This type of strategy can be effective at mid-term to induce psychological changes, and such psychological changes could affect behavior more profoundly and lastingly than the influence exerted only through external changes in the infrastructures (Murray, Walton, & Thomas, 2010).

The present study

The goal of this study is to analyze how the information provided about the personal or social benefits of public transportation can influence the choice of a transportation mode: subway or car. More specifically, we want to determine what information is most effective, taking as reference three variables that affect that choice: trip time variability using one mode or the other (Anable & Gatersleben 2005; Asensio & Matas, 2008; Bates, Polak, Jones, & Cook, 2001; Beirao & Sarsfield Cabral, 2007; Cools, Moons, Janssens, & Wets, 2009; Jakobsson, 2007), personal benefits of using public transportation (Gatersleben & Uzzell, 2007; Maibach, Steg, & Anable, 2009), or the environmental drawbacks of using the car (Bamberg, Hunecke, & Blobaum, 2007; Gardner & Abraham, 2010; Heath & Gifford, 2002; Schultz & Oskamp, 1996). In previous studies, these variables were considered as users' perceptions, whereas in this work, they are considered as informational messages about the characteristics of subway or car use.

For this purpose, an experiment was planned in which we manipulated the information provided about trip time variability using public transportation (subway) or the car, the personal benefits of using public transportation, and the environmental harm caused by the car.

The goal was to verify, in habitual car users to commute to work, whether the manipulation of the information about trip variability, the personal benefits of using the subway, or the harm from car use affected their preference for using the subway or the car, the choice of either vehicle, as well as the perception of control over the time spent on the trip by car or by subway. As we are aware of the influence of previous attitudes towards the subway, in our experimental design, we also measured the instrumental and affective aspects associated with the subway, as well as the symbolic aspects related to the car versus public transportation, in order to verify possible interactions between these attitudinal variables and the experimentally manipulated variables.

It is very difficult to experimentally analyze the influence of variables in the real use of a transportation mode, so the alternative that is often used is to simulate the journey through a realistic scenario (Eriksson, Friman, Ettema, Fuji, & Gärling, 2010; Eriksson, Friman, & Gärling, 2013; Van Vugt, Meertens, & Van Lange, 1995). In all the experimental conditions of our study, we initially used a hypothetical scenario that placed the participants in a setting in which the trip from home to work had similar facilities regardless of whether they used the car or the subway.

Next, they received information about the variability of trip time as a function of the transportation mode. In the condition of high variability of the car, we emphasized that the trip time varied more from day to day if they used the car. In the condition of low variability, we underlined that the variation was low, both by car and by subway. To manipulate the information about personal benefits, we used a

text that pointed out various advantages of using public transportation, such as cost, keeping fit, or the use of time. In the condition without information about these benefits, we used a text of a similar length without any information about personal benefits. With regard to the experimental manipulation of the environmental impact of the car, in the high impact condition, we included a text that underlined the seriousness of the pollution produced by the car, whereas in the low environmental impact condition, we stated that one hoped that over time, pollution problems will have been solved. The texts employed in each condition are shown in the annex.

Our hypotheses included the following points:

- H1. Providing information about trip time variability will influence transportation mode preference and choice. People who are informed that the time spent when traveling by car can be very variable will score higher in preference for the subway, and a higher proportion will choose this mode.
- H2. Information about the personal benefits of public transportation usage will influence the transportation mode preference and choice. People who receive information about these benefits, in comparison to those who do not receive this information, will prefer traveling by subway and will choose this means of transportation to a greater extent.
- H3. Information about the environmental impact of the car will influence transportation mode preference and choice. People receiving information about the environmental deterioration caused by the car will score higher in preference for the subway and will choose this transportation mode more than people receiving information stating that this problem will be solved through technological advances.
- H4. The attitudinal variables linked to means of transportation (instrumental, affective, and symbolic aspects) will influence preference for the subway and the transportation mode choice. We expected a higher preference for and more frequent choice of the subway in the people who score high in instrumental beliefs and in positive emotions towards this mode and score low in the symbolic aspects related to the car.
- H5. Information about trip variability will influence the perception of control of car use. People who were informed that trip time is more variable when using the car than when using the subway will perceive car use as less controllable than people in the low variability condition. We expected no influences as a function of the other variables of our design in the perception of control of the use of the car.
- H6. Instrumental beliefs about the subway will influence the perception of control over this transportation mode. People who score high in these instrumental beliefs will perceive more control when using this mode. We expected no differences in the perception of control of the subway based on other variables of our design.

Method

Participants

Two-hundred and sixty people, Psychology students from the National Open University (UNED), participated voluntarily in this study. All of them resided in Spanish cities that have a subway as an urban transportation mode. The condition to participate was that they habitually used the car to travel to work. The data of 41 participants were eliminated because they did not respond correctly when verifying the experimental manipulations. The final sample of participants included 220 (63.2% women), with a mean age of 37.4 years ($SD = 8.1$).

Design

The participants were randomly assigned to one of the experimental conditions. They all completed an online questionnaire of which there were 16 versions, corresponding to the experimental manipulation and to a counterbalanced presentation order. Variability of trip time by car or by subway, personal benefits of public transportation, and the environmental harm from the car were manipulated in a 2 (Variability of trip time: high vs. low) \times 2 (Personal benefits: information vs. no information) \times 2 (Environmental harm of car: high vs. low) between-subject design. The order of the latter two variables was counterbalanced, so that one half of the sample responded first to the information about the personal benefits, and the other half first to the information about environmental benefits. Previous attitudes towards the subway, based on instrumental attributes, symbolic beliefs, and emotional aspects, were taken into account as covariates.

Dependent Variables

The dependent variables were: (a) preference for the subway versus the car to travel to the hypothetical workplace, measured by an item in the form of scale ranging from 0 (*strong preference for car*) to 6 (*strong preference for subway*); (b) the alternative the participant would choose for that trip (car or subway); (c) the degree of perceived control over the time that it would take to get to work by car; and (d) the degree of perceived control over the time that it would take by subway, these last two items measured in the form of scale ranging from 0 (*none*) to 6 (*very much*).

Procedure and instruments

The participants, residents in Madrid, Barcelona, Valencia, Seville, and Bilbao (Spanish cities that have a subway) were contacted via email, inviting them to be part of the study. The condition was that they habitually traveled to work by car. They were informed about the voluntary and anonymous nature of their participation, and offered detailed

information about the research at the end of the study as compensation that would contribute to their academic formation. If they decided to participate, the email provided a link to the questionnaire they had to complete via Internet. After finishing the study, they received information about the goals and results of the investigation, as well as a detailed explanation about how to elaborate a research report.

The questionnaire contained items of sociodemographic data, scales to measure the instrumental, affective, and symbolic aspects of their attitudes toward the subway and the car, the stories corresponding to the scenarios (which varied as a function of the experimental condition), as well as the dependent variables of preference, choice, and control concerning the car and the subway. The questionnaire was designed so that, once one part had been completed, the participants could not go back to see their previous responses.

Firstly, the participants responded to the sociodemographic data of age, sex, and car use to go to work. Next, they completed the attitudinal scales on a Likert-type format ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). The scale of instrumental features of the subway consists of 9 items (e.g., "It's fast, it saves time," "It is relatively cheap"), with higher scores indicating that more advantages are assigned to this mode of transport. The scale to measure emotions linked to traveling by subway consists of 8 items divided into two subscales (4 positive emotions, e.g., "It's entertaining" or "It's relaxing", and 4 negative emotions, e.g., "It makes you aggressive" or "It's boring"), with higher scores indicating greater intensity of the emotion.

On the scale of symbolic aspects of car and public transportation (3 items, e.g., "When you use public transportation, most people think that you do so because you have no choice"), higher scores indicate a more positive view of the car in relation to public transportation.

Next, participants read the scenario that placed them in a hypothetical situation in which they had to travel from their home to their workplace. The geographical characteristics of the trip were the same in all the experimental conditions, and participants were told that the average trip time was less by car than by subway but, depending on the experimental condition they had been assigned to, they received information about trip time variability to arrive at that workplace by car versus subway (high or low), the personal benefits derived from the use of public transportation versus by car (benefits or no information about benefits), and the environmental deterioration caused by the car (deterioration or solution through new technologies). The order of the latter two variables was counterbalanced so that one half of the sample received the information about personal well-being first, while the other half of the sample received the information about environmental deterioration first. Therefore, 16 experimental situations were designed. Lastly, the participants responded to a series of questions that allowed us to verify the success of the experimental manipulation. Participants who did not adequately recognize the characteristics of each one of the three experimental conditions that described the scenario to

which they had been randomly assigned were eliminated from the analyses.

Results

Preliminary analyses

The one-way ANOVA revealed no differences between men and women in "Preference for the subway", $F(1, 218) = 1.34, p = .25$; "Control of time when traveling by subway", $F(1, 218) = .002, p = .96$; or "Control of time when traveling by car" $F(1, 218) = 2.87, p = .09$. There were no significant sex differences in the choice of subway or car, $\chi^2 = .17, p = .20$. Likewise, we confirmed that none of the dependent variables was significant as a function of presentation order of the counterbalanced conditions: "Preference for subway", $F(1, 218) = .93, p = .34$; "Control of time by subway", $F(1, 218) = .99, p = .32$; "Control of time by car", $F(1, 218) = .243, p = .62$; or "Choice of subway or car", $\chi^2 = .46, p = .49$. Therefore, neither participants' sex nor the counterbalanced order were taken into account in subsequent analyses.

By means of Cronbach's alpha, we verified that the scales used to measure the attitudinal aspects were reliable: Instrumental aspects subway, $\alpha = .76$; Negative emotions subway, $\alpha = .79$; Positive emotions subway, $\alpha = .76$; Symbolic aspects associated with public transportation or car, $\alpha = .70$.

By means of a one-way ANOVA, we also confirmed that the measures of the attitudinal variables were randomly distributed among the experimental conditions, so there were no differences in these attitudinal variables as a function of the experimental condition to which the participants had been assigned. There were no differences due to the condition in Instrumental aspects of the subway, $F(7, 212) = .85, p = .55$; Negative emotions of the subway, $F(7, 212) = .56, p = .79$; Positive emotions of the subway, $F(7, 212) = .72, p = .66$; or Symbolic aspects associated with public transportation or car, $F(7, 212) = .38, p = .91$.

Preference for subway use over car use

An ANCOVA was performed to confirm the effect of the experimental manipulation, the attitudinal variables, as well as of the possible interactions among variables on the dependent variable *preference for subway use over car use*. Regarding the experimental variables, in accordance with our hypotheses, there was a main effect of *variability*, $F(1, 208) = 12.75, p < .001, \eta^2 = .06$. People who were informed that trip duration was greater using the car had a higher average score ($M = 3.83, SD = 2.12$) than those who were informed that there is no difference between using the subway or the car ($M = 2.79, SD = 2.09$). No significant effect of the information about the *personal benefits*, $F(1, 208) = 1.11, p = .29$, was found, although the data indicate that there was a tendency in the direction of the hypothesis, because the mean preference for subway use was higher when information

about these benefits was provided ($M = 3.59, SD = 2.12$) than when it was not ($M = 3.19, SD = 2.20$). The effect of the information about *environmental harm* was nonsignificant, $F(1,208) = .87, p = .35$, although, also in this case, the means showed a tendency in the direction of our hypothesis: the condition of information about environmental harm produced a higher preference for subway use ($M = 3.66, SD = 2.06$) than the no environmental harm condition ($M = 3.08, SD = 2.23$).

With regard to the covariates of the study, a main effect of the *instrumental attitudes* associated with the subway was observed, $F(1, 208) = 9.40, p < .01, \eta^2 = .04$, as well as of the *positive emotions* towards this transportation mode, $F(1, 208) = 11.50, p < .001, \eta^2 = .05$. By means of regression analysis of the variable preference for subway use based on its instrumental attributes, we verified that, as the attitude towards the subway improved, preference for this mode increased [$R^2 = .11, B = .88, t(219) = 5.15, p < .001; F(1, 218) = 26.47, p < .001$], and that the higher the score in the attitude related to positive emotions linked to the subway, the greater the preference for using this mode [$R^2 = .10, B = .70, t(219) = 4.92, p < .001; F(1, 218) = 26.47, p < .001$]. The hypotheses about *symbolic attitudes* or *negative emotions*, which had no significant effect on preference, were not confirmed, and none of the possible interactions among the six independent variables was significant in the ANCOVA ($p > .12$ in all cases).

Table 1. Preference for subway use. Descriptive statistics.

Condition	<i>n</i>	<i>M</i>	<i>SD</i>
High variability, high benefits, high environment	34	3.82	2.13
High variability, high benefits, neutral environment	24	4.04	2.07
High variability, neutral benefits, high environment	33	4.06	1.99
High variability, neutral benefits, neutral environment	30	3.40	2.29
Same variability, high benefits, high environment	22	3.55	2.08
Same variability, high benefits, neutral environment	26	2.69	2.03
Same variability, neutral benefits, high environment	17	2.71	1.82
Same variability, neutral benefits, neutral environment	34	2.41	2.21

Table 1 presents the descriptive statistics of the variable preference for subway use as a function of the experimental condition.

Chosen alternative

With regard to this dependent dichotomic variable, the results obtained partially confirmed our hypotheses, presenting an identical pattern to that found in preference for subway use over car use. To determine how the variables of our model conjointly influence the choice of subway versus car, we conducted a logistic regression ($R^2 = .19$). Table 2 shows that the statistically significant variables were *variability*, positive attitudes based on *instrumental attitudes* towards the subway, and *positive emotions* elicited by this transportation mode.

Table 2. Logistic Regression. Criterion Variable: Choice Alternative (0 car, 1 subway).

	<i>B</i>	<i>ET</i>	<i>Wald</i>	<i>Odd Ratio</i>	<i>IC 95%</i>
Instrumental attitudes towards subway	.62	.22	7.64	1.86**	1.19 - 2.88
Positive emotions subway	.52	.20	6.56	1.69**	1.13 - 2.52
Negative emotions subway	.19	.17	1.25	1.21	.86 - 1.70
Symbolic attitudes	-.10	.11	.80	.90	.72 - 1.12
Variability	.70	.30	5.32	2.01*	1.11 - 3.64
Personal benefits	.16	.30	.28	1.17	.65 - 2.09
Environmental damage	.06	.31	.03	1.06	.58 - 1.92

Note: * $p < .05$. ** $p < .001$.

We analyzed the differences in proportions between choice of car or subway as a function of the 8 experimental conditions (Table 3). In general, we observed a higher preference for the choice of the subway (59.5% of the total) versus the car. The conditions in which these preferences were significant were the ones in which at least two of the benefits provided by using the subway were underlined: high variability, high benefits, high environment; high variability, high benefits, neutral environment; high variability, neutral-benefits, high environment.

When the trip time variability by car is underlined (high variability), a larger proportion of the participants chose the subway (66.9%) instead of the car (33.1%), and this difference of proportions was statistically significant, $\chi^2 = 3.71, p < .01$. In the low variability condition, the choice of the subway (50.5%) was not significantly different from the choice of the car (49.5%), $\chi^2 = .99, p > .05$. In the condition that emphasized the personal benefits of public transportation, a higher proportion of participants chose the subway (62.3%) rather than the car (37.7%), $\chi^2 = 2.53, p < .01$. When this condition was not present, the difference between proportions was lower (57% chose the subway vs. 43% who chose the car), $\chi^2 = 1.49, p > .05$. Similar results were obtained in the experimental manipulation of the environmental harm caused by the car. A higher proportion of people chose the subway instead of the car (63.2 and 36.8%, respectively), $\chi^2 = 2.72, p < .01$, when this condition was present, whereas the difference between the proportions was irrelevant if the environmental harm of the car was not emphasized (56.1% chose the subway vs. 43.9% who chose the car), $\chi^2 = 1.30, p > .05$.

Table 3. Percentage in Choice of Alternative x Condition. Difference of proportions.

Condition	Alternative		Z
	Car	Subway	
High variability, high benefits, high environment	29.4	70.6	-2.40**
High variability, high benefits, neutral environment	25.0	75.0	-2.45**
High variability, neutral benefits, high environment	30.3	69.7	-2.26**
High variability, neutral benefits, neutral environment	46.7	53.3	-.36
Same variability, high benefits, high environment	45.5	54.5	-.47
Same variability, high benefits, neutral environment	53.8	46.2	.39
Same variability, neutral benefits, high environment	52.9	47.1	.24
Same variability, neutral benefits, neutral environment	47.1	52.9	-.34
Total	40.5	59.5	-2.8**

Note: * $p < .05$. ** $p < .001$.

Perceived control when using the car

In accordance with our hypotheses, the ANCOVA on this dependent variable showed that only *variability* had significant influence: $F(1, 208) = 16.66, p < .001, \eta^2 = .07$. In the condition of high variability, people perceived that they would have less control if they used the car ($M = 2.64, SD = 1.57$) than those of low variability ($M = 3.56, SD = 1.59$). In the remaining variables and interactions, no significant effects were found ($p > .08$ in all cases).

Perceived control when using the subway

Confirming our hypotheses, the ANCOVA showed that, in this dependent variable, only the influence of the *instrumental attitudes* towards the subway was significant, $F(1, 208) = 12.51, p < .001$. As shown in the regression analysis, due to their beliefs about the instrumental characteristics of the subway, people perceived it as more controllable [$R^2 = .05, B = .36, t(219) = 3.52, p < .001; F(1, 218) = 12.38, p < .001$]. As expected, the experimental manipulation of variability, personal benefits, or environmental harm caused by cars had no influence on this variable.

Although people in the high variability condition showed a higher mean (4.77) than those of low variability ($M = 4.48$), these differences were nonsignificant ($p = .16$). A possible explanation is that people know that the subway is a reliable transportation mode with regard to trip time, because it has

no traffic variations. The effects of the other variables or their interactions were also nonsignificant ($p > .11$ in all cases).

In addition, we verified the efficacy of the experimental manipulation of time variability by means of a repeated measure MANOVA, with a within-subject factor: perceived control of the car and perceived control of the subway, and a between-subject factor: high or low variability of trip time. A main effect of the within-subject factor was found, $F(1, 218) = 130.55, p < .001$, indicating that the subway was perceived as more controllable ($M = 4.64, SD = 1.25$) than the car ($M = 3.05, SD = 1.65$); the magnitude of this effect was considerable ($\eta^2 = .38$). A significant effect of the interaction of the within-subject factor with variability was found, $F(1, 218) = 19.99, p < .001, \eta^2 = .08$, indicating that, in the high variability condition, this difference was greater, as can be observed in Table 1, thereby confirming the influence of the information about the variability of these two measures of perception of control when considered concurrently.

Table 4. Perceived Control using Car or Subway x Variability. Descriptive statistics.

C. Perceived	Variability	n	M	SD
Car	Low	99	3.56	1.58
	High	121	2.64	1.58
	Total	220	3.05	1.64
Subway	Low	99	4.48	1.28
	High	121	4.77	1.20
	Total	220	4.64	1.25

Discussion

The goal of the present study is to provide evidence of how the behavior of choosing a public transportation mode can be influenced by means of the information provided about the personal or social benefits of this transportation mode. The use of an experimental methodology allowed us to assess the importance of different types of benefits. The characteristics of the sample, people who habitually go to work by car, provide special rigor to the conclusions derived from this investigation.

Providing information about the differences in car trip time variation versus a public mode like the subway influences preference, choice, and perception of control over car usage. Our results are in a similar vein as those provided by diverse works that have revealed the importance of instrumental beliefs in mobility behavior from a psychosocial perspective. Generally, people think that trips by car take less time than does public transportation (Anable & Gatersleben, 2005; Beirao & Sarsfield Cabral, 2007; Jakobsson, 2007), and therefore, they choose the car, although the reliability of trip time may be more important than the time spent on the trip (Cools et al., 2009). As underlined by Bates et al. (2001), and as seen from our results, travelers appreciate a reduction in the variability more than in trip time itself. According to these investigators, there are two reasons for this. The first is

that travelers are sensitive to the aspects that determine trip time variability because of its influence on the hour when they expect to arrive at work. Travelers are assumed, therefore, to choose the alternative that maximizes a function of utility in terms of trip time, guaranteeing a good match between their expectations and their time schedule needs. The second reason is that travelers grant special value to the reduction of the uncertainty caused by trip time variability, regardless of its consequences in terms of time. Uncertainty causes stress and anxiety, and an additional cognitive “overload” if one has to change planned activities. Therefore, the perception of control over the transportation mode is one of the main determinants of their choice.

Our work contributes evidence of a causal relation between information about trip time variability and preferences for a transportation mode, the choice of a public or private mode, and the perception of control over the trip by car. When people are aware that the trip by car is more variable and, therefore, less reliable, they prefer to use public transportation, which can guarantee that they can control how much time they will spend on the trip from their home to the workplace.

Likewise, previous attitudes towards public transportation, based on beliefs about its instrumental attributes or on the affect with which it is associated, are revealed as predictors of the behaviors of preference, choice, and perception of control. These variables do not interact with the experimentally manipulated variables. The expected influence of attitudes based on symbolic beliefs was not significant. This result may be due to the fact that this influence is not direct, but is mediated by its effect on emotions, as reported in previous works (Lois & López-Sáez, 2009; Sevillano, López-Sáez, & Mayordomo, 2011). Thus, people who link public transportation to more negative symbolic beliefs will anticipate more negative emotions and fewer positive ones if they use this mode instead of the car.

As predicted, people who received salient information about the personal benefits derived from the use of public transportation, in comparison with the car, showed a higher preference for the subway and chose it to a greater extent. Although these differences were nonsignificant, the response pattern was in the expected direction. The same pattern of results was obtained with the manipulation of environmental harm. When such harm is underlined, people prefer to use the subway, choosing it to a greater extent than when they received information alluding to the notion that future technological changes in the automobile industry will put an end to atmospheric pollution.

The present results have both theoretical and applied implications. Theoretically, our investigation contributes to the existing literature, unequivocally underlining the causal relation between trip variability and the preference for a public or private transportation mode. This relation had already been noted in many other correlational works but, to our knowledge, no empirical verification had been contributed by means of an experimental design that showed the influence of trip variability. At a practical level, these results show how urban mobility behavior can be modified by means of influence tactics. In accordance with the data obtained, in the context of the use of transportation in cities, publicity campaigns aimed at modifying attitudes should underline the instrumental attributes of the public transportation modes, as well as the reliability in trip time, compared with the car. Likewise, if these campaigns highlight the personal and environmental benefits of public transportation and the harm caused by car use, this would help change attitudes and mobility behaviors because, as seen from our results, simultaneously using information about the various advantages of a public transportation mode, in our case, the subway, improves the influence exerted on such behavior.

The present investigation has some limitations that should be commented on. First, as it is an experimental design, we had to use a simulated context. On the other hand, the sample size is small, if we take into account the number of experimental conditions and the complexity of our design with regard to the number of variables concurrently tested. This could have led to the nonsignificance of some of the hypothesized effects or to the low magnitude of the effects found. On the basis of the results obtained, it would be interesting to verify how the different tactics can influence mobility patterns separately.

However, in the manipulation of the personal benefits, diverse advantages were mixed (saving money, keeping physically fit, or making good use of time) that may be valued very differently by different people. Future research should address whether there are differences in the efficacy of the information provided about personal benefits when they allude to the cost of the trip, health, or entertainment. It would also be interesting to examine whether the results obtained comparing the car to the subway (a prestigious public transportation with regard to its utilitarian features) can be generalized to other types of public transportation.

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References

- Anable, J., & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A*, *39*, 163-181. doi:10.1016/j.tra.2004.09.008
- Asensio, J., & Matas, A. (2008). Commuters' valuation of travel time variability. *Transportation Research Part E*, *44*, 1074-1085. doi:10.1016/j.tre.2007.12.002
- Bamberg, S., Hunecke, M., & Blobaum, A. (2007). Social context, personal norms and the use of public transportation: Two field studies. *Journal of Environmental Psychology*, *27*, 190-203. doi:10.1016/j.jenvp.2007.04.001
- Bates, J., Polak, J., Jones, P. & Cook, A. (2001). The valuation of reliability for personal travel. *Transportation Research Part E*, *37*, 191-229. doi:10.1016/S1366-5545(00)00011-9
- Beirão, G., & Sarsfield Cabral, J. A. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy*, *14*, 478-489. doi:10.1016/j.tranpol.2007.04.009
- Ben-Akiva, M., & Lerman, S.R. (1985). *Discrete choice analysis: Theory and application to travel demand*. Cambridge, MA: The MIT Press.
- Cools, M., Moons, E., Janssens, B., & Wets, G. (2009). Shifting towards environment-friendly modes: Profiling travelers using Q-methodology. *Transportation*, *36*, 437-453. doi:10.1007/s11116-009-9206-z
- Domarchi, C., Tudela, A., & González, A. (2008). Effect of attitudes, habit and affective appraisal on mode choice: An application to university workers. *Transportation*, *35*, 585-599. doi:10.1007/s11116-008-9168-6
- Edwards, R. D. (2008). Public transit, obesity, and medical costs: Assessing the magnitudes. *Preventive Medicine*, *46*, 14-21. doi:10.1016/j.ypmed.2007.10.004
- Ennis, R., & Zanna, M. P. (2000). Attitude function and the automobile. In G. R. Maio & J. M. Olson (Eds.), *Why we evaluate: Functions of attitudes?* New York: Erlbaum.
- Eriksson, L., Friman, M., Ettema, D., Fujii, S., & Gärling, T. (2010). Experimental simulation of car users' switching to public transport. *Transportation Letters*, *2*, 145-155. doi:10.3328/TL.2010.02.03
- Eriksson, L., Friman, M., & Gärling, T. (2013). Perceived attributes of bus and car mediating satisfaction with the work commute. *Transportation Research Part A*, *47*, 87-96. doi:10.1016/j.tra.2012.10.028
- European Commission (2009). *A sustainable future for transport: Towards an integrated, technology-led and user-friendly system*. Directorate General for Energy and Transport. Luxembourg: Publications Office of the European Union. Retrieved from http://ec.europa.eu/transport/publications/doc/2009_future_of_transport_en.pdf
- Evans, G. W., Wener, R. E. & Phillips, D. (2002). The morning rush hour: Predictability and commuter stress. *Environment and Behavior*, *34*, 521-530. doi:10.1177/00116502034004007
- Gardner, B., & Abraham, C. (2007). What drives car use? A grounded theory analysis of commuters' reasons for driving. *Transportation Research Part F*, *10*, 187-200. doi:10.1016/j.trf.2006.09.004
- Gatersleben, B. (2007). Affective and symbolic aspects of car use. In T. Gärling & L. Steg, (Eds.), *Threats to the quality of urban life from car traffic: Problems, causes, and solutions* (pp. 219-233). Amsterdam: Elsevier.
- Gatersleben, B., & Haddad, H. (2010). Who is the typical bicyclist? *Transportation Research Part F*, *13*, 41-48. doi:10.1016/j.trf.2009.10.003
- Gatersleben, B., & Uzzell, D. (2007). Affective appraisals of the daily commute. *Environment and Behavior*, *39*(3), 416-431. doi:10.1177/00116506294032
- Heath, Y., & Gifford, R. (2002). Extending the theory of planned behavior: Predicting the use of public transportation. *Journal of Applied Social Psychology*, *32*, 2154-2189. doi:10.1111/j.1559-1816.2002.tb02068.x
- Instituto para la Diversificación y Ahorro de la Energía (2007). *Guía práctica de la energía: consumo eficiente y responsable*. Madrid: IDAE. Retrieved from http://www.idae.es/uploads/documentos/documentos_11046_Guia_Practica_Energia_3_Ed.rev_y_actualizada_A2011_01c2c901.pdf
- Jakobsson, C. (2007). Instrumental motives for private car use. In T. Gärling & L. Steg (Eds.), *Threats to the quality of urban life from car traffic: Problems, causes, and solutions* (pp. 205-218). Amsterdam: Elsevier.
- Lois, D., & López-Sáez, M. (2009). *The relationship between instrumental, symbolic and affective factors as predictors of car use: A structural equation modeling approach*. *Transportation Research Part A*, *43*, 790-799. doi:10.1016/j.tra.2009.07.008
- Maibach, E., Steg, L., & Anable, J. (2009). Promoting physical activity and reducing climate change: Opportunities to replace short car trips with active transportation. *Preventive Medicine*, *49*, 326-327. doi:10.1016/j.ypmed.2009.06.028
- Mokhtarian, P. L., & Salomon, I. (2001). How derived is the demand for travel? Some conceptual and measurement considerations. *Transportation Research Part A*, *35*, 695-719. doi:10.1016/S0965-8564(00)00013-6
- Monzón, A., Cascajo, R., & Alonso, A. (2013). *Informe del Observatorio de la Movilidad Metropolitana 2011* [Report of the Metropolitan Mobility Observatory]. Ministerio de Agricultura, Alimentación y Medio Ambiente. Retrieved from http://www.observatoriomovilidad.es/images/stories/05_informes/Informe_OMM2011.pdf
- Moreno, M., Corraliza, J., & Ruiz, J. (2005). Escala de actitudes ambientales hacia problemas específicos [Environmental attitudes scale towards specific problems]. *Psicothema*, *17*, 502-508. Retrieved from <http://www.psicothema.com/psicothema.asp?id=3136>
- Murray, S. J., Walton, D., & Thomas, J. A. (2010). Attitudes towards public transport in New Zealand. *Transportation*, *37*, 915-929. doi:10.1007/s11116-010-9303-z
- Sevillano, V., López-Sáez, M. & Mayordomo, S. (2011). *El "vínculo" con los medios de transporte: instrumental, simbólico y afectivo*. *Revista de Psicología Social*, *26*, 257-273. doi:10.1174/021347411795448938
- Schultz, P. W., & Oskamp, S. (1996). Effort as a moderator of the attitude-behavior relationship: General environmental concern and recycling. *Social Psychology Quarterly*, *59*, 375-383. doi:10.2307/2787078
- Steg, L. (2005). Car use: Lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A*, *39*, 147-162. doi:10.1016/j.tra.2004.07.001
- Steg, L., & Gärling, T. (2007). Introduction. In T. Gärling & L. Steg, (Eds.), *Threats to the quality of urban life from car traffic: Problems, causes, and solutions* (pp. 1-7). Amsterdam: Elsevier.
- Steg, L., & Tertoolen, G. (1999). *Affective motives for car use*. European Transport Conference: Transport, Planning, Policy and Practice. Cambridge, London. Retrieved from <http://trid.trb.org/view.aspx?id=651743>
- Steg, L., Vlek, C., & Slotegraaf, G. (2001). Instrumental-reasoned and symbolic-affective motives for using a motor car. *Transportation Research Part F*, *4*, 151-169. doi:10.1016/S1369-8478(01)00020-1
- Stokols, D., Novaco, R. W., Stokols, J., & Campbell, J. (1978). *Traffic congestion, Type-A behavior and stress*. Retrieved from <http://128.200.36.2/its/publications/papers/ITS/UCI-ITS-WP-78-5.pdf>
- Van Lange, P. A. M., Van Vugt, M., Meertens, R. M., & Ruiters, R. A. C. (1998). A social dilemma analysis of commuting preferences: The role of social values and trust. *Journal of Applied Social Psychology*, *28*, 796-820. doi:10.1111/j.1559-1816.1998.tb01732.x
- Van Vugt, M., Meertens, R. M., & Van Lange, P. A. M. (1995). Car versus public transportation? The role of social value orientations in a real-life social dilemma. *Journal of Applied Social Psychology*, *25*, 258-278. doi:10.1111/j.1559-1816.1995.tb01594.x
- Van Vugt, M., Van Lange, P. A. M., & Meertens, R. M. (1996). Commuting by car or public transportation? A social dilemma analysis of travel mode judgments. *European Journal of Social Psychology*, *26*, 373-395. doi:10.1002/(SICI)1099-0992(199605)26:3

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Annex.

Trip context (common to all the conditions)

Imagine that 5 years from now, you find yourself in the following situation. The company you work for is 21 kilometers from your home. This distance can be covered by car or by public transportation (subway). There is a subway station 3 minutes away from your home by foot. From there, the subway takes you to a station that is 2 minutes away from your workplace by foot. However, the entrance to the highway that takes you directly to work by car is close to your home. Other coworkers of the company are in a similar situation and use the same route, some choosing to go by car and others by subway.

VARIABILITY

High

The trip time in public transportation is fairly predictable, because it does not vary much from day to day. The trip by subway takes between 38 and 42 minutes. In contrast, the time trip by car is not very predictable, because it ranges between 18 and 45 minutes, due to parking time and traffic jams. This means that some days, you may get to work by car in 20 minutes, other days, you may need 30 minutes, and some days, it may take 45 minutes. The exact trip time by car or by public transportation depends on a large variety of factors but, in general, trip time by subway is much more predictable than by car.

Low

The trip time, either by public transportation or by car, is fairly predictable because it does not vary much from day to day. The trip by subway takes from 38 to 42 minutes, and by car, 18 to 22 minutes. The exact trip time by car or by public transportation depends on a large variety of factors but, in general, trip time by subway or by car is predictable, and trip duration can be calculated beforehand in each transportation mode.

PERSONAL BENEFITS FOR USE OF PUBLIC TRANSPORTATION

Information of benefits

Scientific studies on the use of a means of transportation have verified that, in comparison to people who travel by car, people who habitually use public transportation to go to work obtain important advantages. For example, the cost of the trip is much lower, which means a considerable saving over the year (in fuel, compulsory car insurance, car overhauls). Moreover, the people who forgo the car and travel by public transportation consume 30% more calories per day, which benefits their health and allows them to maintain an adequate weight. Likewise, they can use the trip time to read, play with their mobile phone or Nintendo, study, work, or even surf the Internet.

Without information of benefits

Scientific studies carried out in diverse countries of the European Union have revealed that the situation in Spain regarding the use of public transportation and of private cars is similar to that of other countries of our milieu. People decide what transportation mode to use as a function of their circumstances. In spite of the differences between countries with regard to public transportation infrastructures and roads, no large variations in citizens' preferences are observed.

ENVIRONMENTAL IMPACT CAR

High impact

We note that the environment in cities is highly deteriorated, which increases the incidence of diseases in the population. In spite of the technological improvements introduced in automobiles (motors that consume less and less contaminating fuels), within 5 years, the environment will still be severely harmed by car use, due to the expected increase in the use of this transportation mode.

Low impact

We note that the environment in cities is highly deteriorated, which increases the incidence of diseases in the population. However, thanks to the technological improvements introduced in automobiles (motors that consume less and less contaminating fuels), within 5 years, the environment will not be so severely harmed by car use, and car use will have a similar environmental impact as that of public transportation.